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residual contents of the emptied container. The system also can include a polyisocyanate or isocyanate prepolymer with a diisocyanate monomer content less than 3% by weight based on the prepolymer, an NCO functionality of 2 to 5, and an NCO content of 8 to 30% by weight based on the weight of the prepolymer with a viscosity of 5 to 200 Pa·s at 25°C.

The low content of diisocyanate monomer in the container after the foam has been expelled can be achieved as follows:

1. Using low diisocyanate monomer content prepolymer which must contain 8-30% by weight NCO groups.
2. Introducing a trimerization catalyst into the pressurized container immediately before or after the contents are released from the container.
3. Introducing an OH containing compound into the pressurized container immediately before or immediately after the contents are removed from the container.
4. Using a cyclotrimer with a low diisocyanate monomer content as the prepolymer.
5. Using polymer MDI with a low diisocyanate content as the prepolymer.

The system of the invention comprises a disposable pressurized container containing a polyisocyanate composition having an NCO content of from about 8 to 30% by weight based on the weight of the prepolymer, at least one catalyst for the reaction of an isocyanate group with an OH group, at least one blowing agent and at least one foam stabilizer.

The polyisocyanate or polyisocyanate prepolymer must have an NCO content of from about 8 to about 30% by weight based on the weight of the prepolymer. The high NCO content is required to permit the foam composition to cure rapidly so that the foam does not collapse before the cell walls are stabilized to the required extent to support the foam.

The container must also contain at least one catalyst for the reaction of the isocyanate group with an OH group. This is required to permit the foam to polymerize

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at a rate sufficiently rapid to stabilize the walls of the foam cells before the foam collapses.

The system of the invention also requires the presence of a blowing agent to form the foam when the contents of the container under pressure are released.

The composition of the present invention must also contain a foam stabilizer, which provides a foam with the required cell size.

All of the components must be present in the composition for it to effectively function as a system for producing a foam. Other optional ingredients can be incorporated in the composition but the polyisocyanate or isocyanate prepolymer having an NCO content of from about 8 to about 30% by weight of the prepolymer, the catalyst, blowing agent and foam stabilizer are critical to the composition. Applicants submit that the prior art cited by the Examiner neither teaches nor suggests the present invention.

The claims stand rejected under 35 U.S.C. §103(a) as obvious over Pauls. (U.S. 4,263,412) in view of Schmalstieg et al. (CA 2084698; herein after noted as Canada) and Minato et al. (U.S. 5,086,175). Applicants respectfully submit that the references whether considered alone or in combination neither teach nor suggest the present invention.

Pauls is related to the prior art disclosed by applicants. Pauls discloses a system for dispensing one component polyurethane foam from a container in which the foaming components are separated by a flexible membrane from the propelling gas. The device has the advantage that only a small amount of the foaming agent is required. The small amount of foaming agent permits selection from a broader range of foaming agents since certain useful foaming agents are soluble to only a limited extent in one component systems. Pauls represents the prior art cited by applicants.

Pauls teaches that the components which react to form the isocyanate component of the mixture are introduced into the container and reacted therein (see examples 1 to 27, column 7 lines 54, 55 and column 8 lines 25-29). A less preferred method is to react the isocyanate forming components in a kettle and pack the reaction

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mixture from the kettle into the container. As is known in the prior art, since the ratio of NCO groups to OH groups is preferably from 4 to 8, the amount of unreacted diisocyanate monomer in the contents of the container is high (greater than 5% by weight of the isocyanate component).

The large amount of unreacted diisocyanate monomer in the contents of the Pauls container presents no problem; since at column 7, lines 61-65, Pauls teaches:

"The inner container (1), the special shape of which permits virtually complete expulsion of the foamable prepolymer mixture containing isocyanate groups, consists either of aluminum or a resilient plastic, e.g., high pressure polyethelene." (Emphasis added by applicants.)

Applicants submit that since the Pauls device permits virtually complete expulsion of the foamable prepolymer mixture containing diisocyanate monomer from the container, there is no incentive to reduce the content of diisocyanate monomer in the contents of the container to ease waste disposal. Since Pauls teaches that the preferred method of filling the container is by reacting the components in the container of the system or in a separate container then filling the system, which methods produce a foaming composition with a high concentration of diisocyanate monomer, applicants submit that Pauls is not concerned with the high concentration of monomer in the contents of the container since the container is virtually emptied due to its unique design and little monomer or prepolymer remains in the container after the foaming composition is expelled. There is no concern with a high monomer content in the foaming composition since little foaming composition remains in the container after use.

There is no suggestion in Pauls to use a low monomer content foaming composition or a composition which has a low monomer content after the system is used. In addition, there is no teaching that low diisocyanate monomer content diisocyanates would provide a useful foaming resin. As is known in the art, the foamed

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mixture must react rapidly to stabilize the foam before the form can collapse.

The deficiencies in the teaching of Pauls are not cured by combination with Canada and Minato et al. Canada and Minato et al. disclose isocyanate-containing compositions having a low content of diisocyanate monomers which are useful for lacquers and adhesives. As set forth in the references, Canada and Minato et al. teach that a prepolymer is prepared using an excess of the diisocyanate monomer and the excess unreacted diisocyanate monomer is removed from the reaction mixture by a distillation process. The amount of unreacted diisocyanate monomer in the composition can be less than 0.1% by weight of the composition (see Canada). However, the composition with the low content of unreacted diisocyanate is expensive to produce and is used in two component systems. One skilled in the art would have no incentive to include such an expensive material in the formulation used in the container of Pauls. The Pauls container permits virtually complete expulsion of the foamable prepolymer mixture and therefore the empty container does not present a disposal problem.

The Canada reference is not pertinent to the present invention. The Canada polyisocyanate is a solid material and would not produce an adequate foam and could be dispensed from the container only with difficulty. The isocyanate prepolymer or polymer must be a liquid material if the process of the present invention is to be operable. Appellants submit that the solid nature of the polyisocyanate of Canada would discourage its use in the system of the invention. The composition of Canada is specifically developed to be soluble in certain solvents to be useful as a lacquer or coating composition. The composition was developed to provide a long pot life (5 days) and a long drying time (13 hours or 55 hours for comparison composition).

There is no suggestion that the Canada composition could produce a suitable foam in view of its long pot life and long drying time.

There is no teaching or suggestion in the combination of Pauls with Canada that any polyurethane prepolymer with a low content of monomer would be useful as a

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single polymerizable component foaming composition without substantial quantities of the diisocyanate monomer present in the composition. Before the present invention, all single component polyurethane foam forming compositions provided in pressurized cans contained substantial quantities of diisocyanate monomers in the foam forming composition. As one skilled in the art understands, the foam must cure rapidly to prevent foam collapse and the monomers are faster reacting than the polymers or prepolymers as shown in Canada (long pot life, long drying tie). The foam of the present invention is tack free (dry) in less than about 9 minutes as shown in the examples. The slow curing solid polyisocyanate composition of Canada would not teach or suggest their usefulness in a single component foaming composition.

Minato et al. in combination with Pauls or Pauls in view of Canada neither teaches nor suggests the present invention. Minato et al. discloses a polyisocyanate having an isocyanate ring having some of the isocyanate groups reacted with a monohydroxy alcohol containing from 10 to 50 carbon atoms. The addition of the long chain alcohol to the polyisocyanate improves the solubility of the polyisocyanate in nonpolar solvents and lowers the viscosity of the prepolymers. Minato et al. appears to be concerned with the solubility of the prepolymer and apparently lowers the diisocyanate monomer content to improve the solubility.

The Minato et al. polyisocyanate is useful in a two component coating or adhesives composition. However, there is no teaching in Minato et al. of the level of diisocyanate monomer in the composition or the curing time of the two component coating composition or if the material would be useful as a one component foam forming composition. These properties are not important to Minato et al. and the focus is on the solubility of the prepolymer in a nonpolar solvent. It is well known that diisocyanate monomers are not soluble in nonpolar solvents (Minato et al. col. 2, lines 3-5).

The examiner's rejection over Minato et al. is based on speculation and assumption which are not grounds on which a rejection under 35 U.S.C. 103(a) can be

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based.

Nowhere in the teachings of Canada and Minato et al. is there any suggestion that the polyisocyanate would be useful in a foaming application. The Minato et al. composition was developed to be soluble in nonpolar solvents so that effective lacquer formulations could be made. The composition is particularly useful in a two package coating system. Canada discloses solid polyisocyanates which are useful in two component lacquer formulations. The polyisocyanates of Canada are generally dissolved in a solvent. Since it is preferred that the system of the present invention is a one component system and does not contain a solvent, Applicants submit that Canada and Minato et al. in combination with Pauls neither teaches nor suggests the present invention.

As shown by the examples, the composition of Canada would not be useful as a one shot foaming material due to its long drying time (13 hours). In addition, since the prepolymers are solids, they would not be useful in the practice of the present invention since they would be difficult to dispense from a pressure pack.

Applicants submit that as disclosed in Canada, it is known in the art to prepare polyisocyanate containing compositions with a low content of diisocyanate monomer. However, these compositions are known for use in lacquers or adhesives and generally have long curing times. Lacquers and adhesives are relatively expensive materials which can afford the extra process steps in preparing the low diisocyanate monomer material. However, there would be no incentive for one skilled in the art to include the expensive low diisocyanate content material in a system for forming a foamed resin comprising the container of Pauls from which virtually all of the contents are expelled, to reduce the expense of disposing of the container.

Applicants respectfully submit that the rejection over the combination of Pauls in view of Canada and Minato et al. is improper. To formulate a rejection over a combination of references there must be some suggestion in the references to make the combination. As discussed above, the only suggestion to combine the teachings of

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the references is in the present application. Clearly, one skilled in the art would not be led to include a low diisocyanate monomer content prepolymer in the container of Pauls, since the single component foaming mixture is virtually completely expelled from the container and the empty container would not present a disposal problem. Applicants therefore submit that the rejection is improper and request that it be reconsidered and withdrawn.

Applicants have provided a novel and unobvious system for providing a plastic foam. The system has a major unrecognized advantage in disposal of the empty container. Applicants submit that the prior art cited by the examiner provides no teaching or suggestion of the system of the invention. Pauls teaches the known system for forming foams; Canada discloses low monomer content materials used for coatings and adhesives. There is no suggestion or incentive to combine the teachings of the references.

The combination of Pauls with Canada and Minato et al. is deficient in not teaching or suggesting that polymeric isocyanates or polymeric MDI be utilized as the polyisocyanate in a one component polyurethane foam forming system. There is no teaching or suggestion that polyisocyanates and polymeric MDI are suitable foaming agents for one component foam systems without the presence of the diisocyanate monomer with its higher rate of reaction.

In view of the above, applicants submit that the present invention is neither taught nor suggested by the combination of Pauls, Canada and Minato et al. and request that the examiner reconsider and withdraw the rejection.

Applicants also submit that use of a low diisocyanate monomer content prepolymer is only one possible solution to the problem, provided by the system of the present invention.

Disposable containers for generating foam plastic are known. However, the prepolymers utilized in the known systems were formed by mixing a large excess of the diisocyanate monomer with OH terminated diols in the container to form a useful

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prepolymer. However, since the compositions require a large stoichiometric excess of the diisocyanate, the compositions contain high concentrations of unreacted diisocyanate monomer. The present invention provides a method for forming a system which provides for residues with low monomer content in the pressurized container after use. The container can be designed to introduce an isocyanate cyclotrimer catalyst into the composition immediately before, during or after the contents have been removed from the container or introducing a low molecular weight alcohol into the container after the foam producing contents have been expelled from the container. Trimerization catalyst or the alcohol provide reactions which remove the diisocyanate monomer from contents of the container.

Systems for producing foamed plastics from pressurized containers were well known at the time the present invention was made. However, the systems were not concerned with residual amounts of unreacted diisocyanate monomer in the pressurized container. The systems all contained substantial amounts of unreacted diisocyanate monomer in the container or the container was designed to expel substantially the entire contents of pressurized container so that there was little or not diisocyanate monomer material remaining in the pressurized container.

In formulating the rejection, the Examiner is completely ignoring the properties of the cured and uncured compositions containing large amounts of diisocyanate monomers.

As shown in Canada and Minato et al., the properties of the uncured and cured composition is determined by the composition and even by the method by which the composition was prepared. Applicants submit that in the prior art, foaming compositions contained large amounts of unreacted diisocyanate monomers; there was no assurance that a composition which did not contain the large amounts of unreacted diisocyanate monomer would provide a composition that provided a useful foam product. There is no assurance in the prior art that low diisocyanate monomer content material would provide useful single component foams.

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Applicants submit that the large amounts of unreacted MDI in the Pauls composition (28%-33%) would be expected to produce a foam with substantially different properties from a composition which did not contain substantial amounts of unreacted diisocyanate monomer. One skilled in the art would not know whether the composition of the present invention would produce useful foams.

The rejection appears to be based on the Examiners speculation that all prepolymer mixtures produce useful foams. This is a false speculation since it would be clear that the Canada formulation at least would not provide a useful foam since it is a solid rather than a liquid, a solvent is required and the composition has such a long curing time that the foam would collapse before it was cured.

The Minato et al. composition would not produce a useful foam since a solvent is required. In addition, Minato et al. fails as a reference since there is no teaching of the level to which the monomer diisocyanate must be removed or the curing time of a one component system.

The following arguments were set forth in the Examiner's Answer mailed May 4, 2005, and are held to still apply:

Applicants submit that a rejection based on a combination of two references which cannot be used to form a foam with Pauls is untenable and request that the rejection be reconsidered and withdrawn.

"Appellants argue that an ordinary practitioner would not have the incentive to use the relatively expensive means for neutralizing excess isocyanate in the expended systems of Pauls. However, the fact that these efforts may be expensive relative to their environmental benefits has no bearing whether motivation is evident. An ordinary practitioner in the art would logically and obviously be directed towards using low toxic monomer containing prepolymers available to him in a prepolymer dispensing system if environmental integrity was at the forefront of his endeavors. Appellants invention as claimed is utilizing that which is known to the art to the achievement of obvious ends and no invention in a patentable sense is seen. Interest in environmental safety is motivation to avoid toxic materials.

Appellants maintain that the cited references are from nonanalogous art. However, it is held that the determination that a reference is from a nonanalogous art is twofold. First, it is decided if the reference is within the field of the inventor's endeavor. If it is not,

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then it must be determined whether the reference is reasonably pertinent to the particular problem with which the inventor was involved. In re Wood, 202 USPQ 171, 174; In re Clay, 23 USPQ 2d 1058. Disclosures of preparing isocyanate components for polyurethane synthesis having reduced monomeric isocyanate contents is at least pertinent to the endeavors of a referenced inventor who is using isocyanates in preparations of isocyanate components used in prepolymers which are dispensed from cans. The fact that the secondary references may not form foams does not negate their pertinence and relevance to the endeavor of preparing polyurethane products whose fundamental behaviors at a chemical level are not affected by the presence or absence of a blowing agent. Accordingly, it is maintained that an ordinary practitioner in the polyurethane arts would find the teaching of Canada and Minato et al. relevant and pertinent to the teaching of Pauls.

Appellants argue that the low monomer containing isocyanate based materials of Canada are solid. However, it is not seen that such is evident for the full disclosure of Canada, and, further, it is not seen that the materials encompassed by the full disclosure of Canada excludes liquid low monomer containing isocyanate based materials. Canada is maintained to be relevant and pertinent.

Rejection is maintained above for all of the claims, and no further arguments concerning individual claims, except as set forth below, are held to be needed.

Examiner holds that the NCO content value range of 26-30% (present in claim 28 and 53) is not required by all claims, and, further, the Pauls reference discloses flexibility in control of NCO contents. Accordingly, variations in NCO content values is a variable which would have been within the practitioners expertise having the teachings of Pauls before them in order to arrive at the products and/or processes of applicants' claims with the expectation of success in the absence of a showing of new or unexpected results.

The viscosity values of various appellant claims are not specifically recited by the teachings of the cited references. However, these are held to be inherent properties attributable to the liquid condition of the various materials of the instant concern, and patentability based on such a claim element is not seen nor have these values been associated with the patentability in the instant case."

In the first paragraph the examiner appears to assume that any polyisocyanate would be useful in a one component foaming system. However, it can be seen from at least Canada that the solid (at least in all the examples) polyisocyanate would not be useful as a one component foaming system in view of its solid character and long curing time. In addition, the diisocyanate is limited to tolylene diisocyanate prepolymers with a low level of diisocyanate monomer in the composition. Applicants therefore submit that the examiner's statement is based on speculation and conjecture.

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In the second paragraph the examiner states:

"The fact that the secondary reference may not form foams does not negate their pertinence and relevance to the endeavor of preparing polyurethane products whose fundamental behavior at a chemical level are not affected by the presence or absence of a blowing agent."

The statement by the examiner clearly indicates that it is his position that any polyisocyanate, no matter what its properties would be useful for forming useful foams, clearly this position is not tenable. The basic prepolymer composition must be able to be expelled from the container, be foamed by the blowing agent and cure sufficiently rapidly so that the foamed composition cures before the foam collapses. These properties are not possessed by all polyisocyanates and particularly not possessed by the solid, slow curing composition disclosed in Canada. The composition of Canada was designed to not have the required properties of a useful foaming composition (rapid cure and reasonable viscosity at ambient temperatures).

Minato et al. is not pertinent since none of the critical parameters including diisocyanate monomer content and curing time are disclosed.

There is no teaching nor suggestion in Canada and Minato et al. that the composition would be useful for forming a foam forming composition. Applicants submit that an invention must be made in finding a low diisocyanate monomer content material which would be useful for forming a single reaction component foam forming composition.

In the third paragraph, the examiner states:

"Appellants argue that the low monomer containing isocyanate base materials of Canada are solid. However, it is not seen that such is evident for the full disclosure of Canada, and, further it is not seen that the materials encompassed by the full disclosure of Canada excludes liquid low monomer containing isocyanate based materials."

The examiner has failed to point out to applicants where in Canada is there a teaching or suggestion that the polyisocyanate prepolymer contains substantial amounts of diisocyanate monomer and is liquid. All of the examples contain low amounts of monomer and are solids. Even the comparison example (4) contained only 0.23% by

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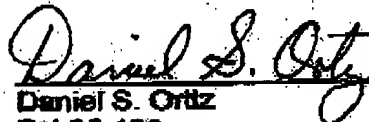
weight monomer and had a viscosity of 400,000 mPa.s at 100°C and would be a solid at ambient temperature. At page 4, line 12, 13 Canada teaches "the polyisocyanates according to the invention are then obtained in the form of semi-rigid resins". Applicants submit that the liquid form of the resins postulated by the Examiner is contrary to the teachings of Canada.

Applicants submit that the examiner's rejection is based on speculation and assumption and not on the teachings of the references considered in their entirety. It is fundamental patent law that all references must be considered in their entirety.

Applicants further submit that there is neither teaching nor suggestion that a foaming composition comprise a major portion of polymer MDI and a NCO content of 26% to 30% by weight as the prepolymer therefore claims 28-33 and 53-58 are patentable over the prior art of record.

In view of the above discussion, Applicants respectfully submit that the rejection of the claims is untenable and request that the rejection be reconsidered and withdrawn.

Respectfully submitted,



Daniel S. Ortiz

RN 25,123

Attorney for Applicant

610-278-4920

Henkel Corporation
Patent Law Dept.
2200 Renaissance Boulevard, Suite 200
Gulph Mills, PA 19406